

Application Serial No. 10/734,108
Amendment dated January 26, 2005
Reply to Office action of October 27, 2004

REMARKS

Claims 1 through 17 are pending in this application. Claims 1 and 5 are amended herein. Claims 7 through 17 are added herein. Support for the new claims may be found in the claims as originally filed as well as at page 6, lines 31-33, page 7, lines 1-16 and 24-30, page 9, lines 19-30, page 10, lines 15-21, page 11, lines 7-24, and page 12, lines 8-28 of the specification and in Figs. 2 and 4-7. Reconsideration is requested based on the foregoing amendment and the following remarks.

Claim Rejections - 35 U.S.C. § 112:

Claim 5 was rejected under 35 U.S.C. § 112, second paragraph, as indefinite. The recitation "solid fraction" is asserted to be unclear. U.S. Patent No. 6,432,160 to Norville, et al., cited in the Office action, describes "fraction of solids (0.7 to 0.8)" at column 3, lines 34 and 35 without reference to volume or weight. Since the phrase "fraction of solids" is substantially equivalent grammatically to the recitation "solid fraction", and since a valid U.S. patent like Norville is presumed to conform to the applicable patent statutes, claim 5 is submitted to be as definite as the Norville reference. However, in the interest of compact prosecution only, and not for any reason of patentability, the Applicants have amended claim 5 to recite "by weight." Dautre et al., US 6,428,636, cited in the Office action, applies the qualifier "weight" to solid fraction at, inter alia column 7, lines 36, 37, 40, 49 and 50. It is thus submitted that those of skill in the art would have interpreted claim 5 in a substantially similar manner. Withdrawal of the rejection is earnestly solicited.

Claim Rejections - 35 U.S.C. § 103:

Claims 1, 2, 5, and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over Dautre in view of Norville. The rejection is traversed. Reconsideration is earnestly solicited.

Claim 1 recites:

"said electromagnetic field is applied to said sleeve before the completion of said loading of molten metal."

Neither Dautre nor Norville teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, as recited in claim 1. Since

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neither Dautre nor Norville teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, their combination cannot, either.

In particular, the present invention applies an electromagnetic field to the sleeve before the completion of the loading of molten metal. In this case, when the molten metal contacts the surface of the sleeve, strong super-cooling is generated at the surfaces of the sleeve, so that it is possible to generate nuclei uniformly throughout all of the molten metal in the sleeve.

Norville, on the other hand, uses a thermal jacket and an electromagnetic field generating apparatus for maintaining a temperature of molten metal, and for breaking dendrites. Thus, the stirring unit of the present invention is different from the electromagnetic field generating apparatus of Norville.

Therefore, if one having ordinary skill in the art makes an apparatus and processes slurries using the Dautre invention in view of Norville, materials having a grain size of 150-200 μm will be obtained, and the sizes of the grains at the center portion and the surface of the vessel are non-uniform.

Finally, porous plug 54 and removable closure 56 of Dautre are meant for throwing away materials in the liquid state remaining in crucible 46 afterwards, as described at column 7, lines 8-10, and thus removable closure 56 is different from the shutter unit which closes the other end of the sleeve to form a base of the sleeve and opens the base of the sleeve to discharge a slurry after manufacture from the sleeve recited in claim 1.

Claim 1 recites further:

"a stirring unit which applies an electromagnetic field to the molten metal in the sleeve."

Dautre neither teaches, discloses, nor suggests a stirring unit which applies an electromagnetic field to the molten metal in the sleeve, as acknowledged graciously in the Office action. The Office action seeks to make up for the deficiencies of Dautre with respect to claim 1 by combining Dautre with Norville, saying, "It would have been obvious to one having ordinary skill in the art to provide Dautre et al the use of a stirring unit for the sleeve as taught by Norville et al in order to effectively control temperature and non-dendritic and solid fraction of semi-solid metallic slurry in the sleeve."

Dautre, however, controls temperature effectively by "providing a crucible at a crucible initial temperature below the solidus temperature, pouring the metallic alloy into the crucible,

and allowing the temperature of the metallic alloy and the crucible to reach an equilibrium at the semi-solid temperature." as described at column 2, lines 34-39. Doutre is complete in itself. There is no reason to believe that Doutre's method of controlling temperature by allowing the temperature of the metallic alloy and the crucible to reach an equilibrium at the semi-solid temperature is in any way deficient, or amenable to being improved, based on the evidence of record. Furthermore, there is no reason to believe the temperature control of Doutre would benefit from stirring of any type, let alone electromagnetic stirring.

Furthermore, Doutre associates stirring with conventional casting practice at column 1, line 37, and warns against the stirring associated with conventional techniques at column 1, lines 43-47, where he writes,

"In the conventional semi-solid casting technique," (i.e. with stirring), "careful control is required over the heating and cooling parameters, specifically the holding temperature at which the processing apparatus is maintained."

Doutre thus teaches away from providing a stirring unit, as recited in claim 1, rather than leaving persons of ordinary skill in the art at the time the invention was made with any impression that adding electromagnetic stirring would be an improvement over Doutre's method of controlling temperature by allowing the temperature of the metallic alloy and the crucible to reach an equilibrium at the semi-solid temperature.

Furthermore, Doutre warns,

"for commercial purposes the conventional approach," (i.e. with stirring), "is confined to use with alloys having a low rate of increase of the fraction of solids with decreasing temperature, at the semi-solid processing temperature. Consequently, many alloys are excluded from practical commercial semi-solid processing, unless a high degree of control on temperature (requiring expensive equipment) is achieved. This high degree of control is not possible or not practical for many commercial semi-solid casting operations."

at column 1, lines 43-47. Doutre thus teaches further away from providing a stirring unit, as recited in claim 1. Since Doutre teaches away from providing a stirring unit it is submitted that persons of ordinary skill in the art at the time the invention was made who read Doutre for all it contained would have been deterred from modifying Doutre as proposed by the Office action. Claim 1 is submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

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Claims 2, 5, and 6 depend from claim 1 and add further distinguishing elements. Claims 2, 5, and 6 are thus also submitted to be allowable. Withdrawal of the rejection of claims 2, 5, and 6 is also earnestly solicited.

Claims 3 and 4 were rejected under 35 U.S.C. § 103 as being unpatentable over Doutre in view of Norville, and further in view of Nakao et al., U.S. 6,505,670. The rejection is traversed. Reconsideration is earnestly solicited.

Claims 3 and 4 depend from claim 1 and add further distinguishing elements. Neither Doutre nor Norville teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, as discussed above with respect to claim 1. Nakao doesn't either, and thus cannot make up for the deficiencies of Doutre and Norville with respect to claims 3 and 4. Since neither Doutre, Norville nor Nakao teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, their combination cannot, either.

Furthermore, Doutre neither teaches, discloses, nor suggests a stirring unit which applies an electromagnetic field to the molten metal in the sleeve, as acknowledged graciously in the Office action. Doutre, in fact, teaches further away from providing a stirring unit, as discussed above with respect to claim 1. Nakao discloses no electromagnetic stirring unit at all, and thus cannot make up for the deficiencies of Doutre with respect to claim 1. Claims 3 and 4 are thus also submitted to be allowable, for at least the reasons discussed above with respect to claim 1. Withdrawal of the rejection of claims 3 and 4 is also earnestly solicited.

New claims 7 through 17:

Independent claims 7 and 14 recite, inter alia, "said electromagnetic field is applied to said sleeve before the completion of said loading of molten metal." Neither Doutre, Norville nor Nakao teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, as discussed above with respect to claim 1. Since neither Doutre, Norville nor Nakao teach, disclose, or suggest applying an electromagnetic field to a sleeve *before* the completion of loading of molten metal, their combination cannot, either.

Independent claims 7 and 14 recite further, "applying an electromagnetic field to the sleeve with a stirring unit." Doutre neither teaches, discloses, nor suggests a stirring unit which

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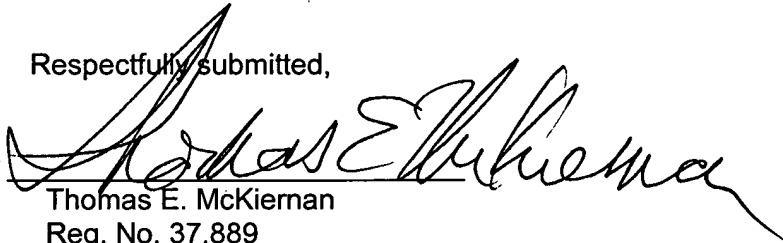
applies an electromagnetic field to the molten metal in the sleeve, as acknowledged graciously in the Office action. Dautre, in fact, teaches away from providing a stirring unit, as discussed above with respect to claim 1. Nakao discloses no electromagnetic stirring unit at all, and thus cannot make up for the deficiencies of Dautre with respect to claim 1. Claims 7 and 14, along with claims 8 through 13 and 15 through 17 dependent thereon, are thus also submitted to be allowable, for at least the reasons discussed above with respect to claim 1.

Conclusion:

Accordingly, in view of the reasons given above, it is submitted that claims 1 through 17 are allowable over the cited references. Allowance of claims 1 through 17 and of this entire application are therefore respectfully requested.

Respectfully submitted,

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